Tree Species Diversity of the Remaining Forest Fragments in Cavite, Luzon Island, Philippines

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ABSTRACT

Cavite has remaining secondary lowland forest fragments that are believed to be either remnant from commercial logging activities ca. 25-45 years ago or as a direct result of land conversions for agriculture or human settlements. There have been no vegetation studies among these forest fragments except in Mt. Palay-Palay in 2004. The aim of the research was to describe these remaining forest fragments (in addition to Mt. Palay-Palay), their tree species diversity, composition, ecological assessment and current anthropogenic threats affecting these areas. Vegetation analysis was performed using the Point-Centered Quarter Method (PCQM) in 72 100-m transects in forest fragments with different habitats. Species diversity was computed using Shannon's diversity index (H′). A total of 2,853 tree individuals belonging to 50 families, 127 genera, and 174 species was encountered. Species diversity indices (H′) in all forest fragments were high and their importance value indices (IVIs) fall within the range of IVIs of tropical forest inventories. Assessment of ecological status revealed that of the 174 species, 44 (25.3%) are endemic, 114 (65.5%) are native/indigenous, and 16 (9.2%) are exotic/introduced. Thirty-nine angiosperms are threatened representing 8.9% of all threatened angiosperms in the Philippines. Overall, Cavite's remaining forest fragments are diverse in terms of tree species and all experience anthropogenic threats and it is highly recommended that they be protected and conserved including the diverse fauna and flora associated with these areas.

KEY WORDS :

Anthropogenic pressures
Diversity index
PCQM
Secondary lowland forest
Threatened
Vegetation analysis

INTRODUCTION

Habitat loss and fragmentation due to anthropogenic activities remain to be the gravest threats to general biodiversity loss (FAO, 2010; Jackson and Fahrig, 2013; Wu 2013). Human land uses include agriculture, settlement, industrialization and resource extraction (e.g. timber harvesting). Worldwide, Southeast Asia has the highest relative rate of deforestation of any major tropical region and many countries in this region have already lost vast stretches of forest particularly the lowland dipterocarp type (Woodcock *et al.,* 2011; Rademaekers *et al*., 2010; Hansen *et al*., 2008; ITTO, 2008; Poffenberger, 2006; Avissar and Werth, 2005; Sodhi *et al*., 2004; Achard *et al*., 2002; Kartawinata *et al*., 2001, 1989; Potter, 1993). In particular, the Philippines has likely suffered the most devastating costs of large-scale deforestation (Heaney and Regalado, 1998) in Southeast Asia. Tumaneng-Diete *et al*. (2005) claimed that deforestation has reduced the forested land area from 56% in 1930 to approximately 21% of the total land area in 1991. An analysis of Philippine forest cover through LANDSAT ETM+ in 2000-2002 revealed that Cavite ranked 73rd in the country in terms of total forest cover with 1,864 ha (1,852 ha=broadleaf closed canopy + 12 ha =mangrove). This represents only 1.49% total forest cover compared to its land area of 124,720 ha (Walpole, 2010: table 3).

Cavite is one of the provinces in the Calabarzon region - which is now regarded as an "industrial belt of the country" (oxfordbusinessgroup.com). Cavite (together with Batangas) now hosts the highest concentration of high-tech industries and electronics in the region. Historically, the province was not spared from logging and its remaining

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forest fragments are either remnants from commercial logging activities ca. 25-45 years ago or as a direct result of land conversions for agriculture or human settlements (Tumaneng-Diete *et al.*, 2005; Liu *et al.*, 1993). Biodiversity studies were focused mainly in Mts. Palay-Palay Mataas-na-Gulod Protected Landscape (henceforth 'Mt. Palay-Palay') and no vegetation studies have been done in the other forest fragments. The objectives of the study were 1) to identify Cavite's remaining forest fragments (in addition Mt. Palay-Palay), 2) to determine diversity, composition and assessment (conservation and ecological) status of tree species of the fragments and 3) to identify current threats in these areas. Data that will be generated from this study can serve as baseline information to recommend measures for the conservation of these remaining forested areas.

METHODOLOGY

Identification of forest fragments and anthropogenic threats. The different forest fragments (Figure 1) were initially identified through interviews with local government officials of each of Cavite's municipalities. Their presence were then validated by reconnaisance and described in terms of locality, coordinates, elevation, and forested area (in ha). The number of transects sampled from each forest fragment depended on the availability of habitats (Table 1). For each forest fragment, different anthropogenic threats were identified and documented.

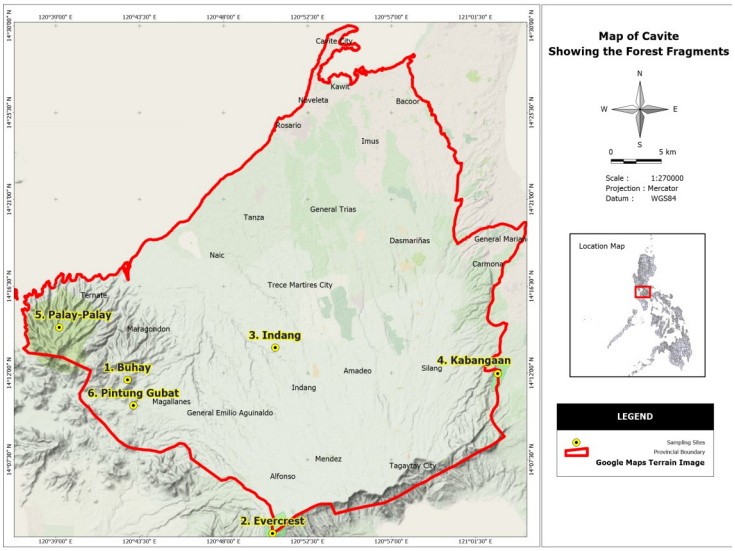

Figure 1. Map of Cavite (outlined in red) showing the forest fragments. Modified from Google Earth 2011.

Vegetation analysis. Vegetation analysis was performed using Point-Centered Quarter Method or PCQM (Cottan and Curtis, 1956) in 72 100-m transects in 6 forest fragments (Table 1). The PCQM used along line transects reflects maximum diversity and provides average values of density and tree size (Korning *et al.* 1990). Transects were established (at least 150 m apart) along selected areas of the fragments based on habitat types. Using this method, a 100-m transect was further subdivided into ten 10-m portions. At each point (with a total of 10 points) diameter-at-breast height (dbh; in cm) and distance (m) of the four nearest trees (with ≥ 10 cm dbh) in each quarter were measured. Tree species diversity was represented by the Shannon–Wiener index (H′). This yielded the importance value index (IVI) - the sum of relative density, relative dominance, and relative frequency of tree species in the different sites. IVI indicated the most important tree species in each forest fragment.

Identification, classification, and assessment of tree species. Herbarium specimens were collected and processed following procedure for herbarium preparation adopted from Bridson and Forman (1992), Castro (2006), and Simpson (2006). Plants were identified and ecologically assessed as either endemic, native/indigenous, or introduced/exotic using these references: Madulid (1995), Fernando *et al.* (2004), Co *et al.* (2006), Pancho and Gruezo (2008), Flora Malesiana Series (1995–2007), and Co's Digital Flora of the Philippines (Pelser et al. 2011). Specimens were also compared with those deposited in the Philippine National Herbarium (PNH). The identification of specimens was verified by Mr. Danilo Tandang of the PNH. Specimens were deposited in De La Salle University-Dasmariñas' Herbarium at the Natural History Room and the PNH. The plants were classified into families using the Angiosperm Phylogeny Group (APG) IV of 2016. In terms of conservation status, trees were assessed as either vulnerable (VU), endangered (EN), critically endangered (CR), Other Threatened Species Lower Risk/near threatened (OTS LR/nt), Other Wildlife Species Lower Risk/least concern (OWS LR/lc), and Lower Risk least concern (LR/lc) based from IUCN Red List 2011 and The National List of Threatened Philippine Plants and their Categories 2007 (DENR Administrative Order 2007-01).

RESULTS AND DISCUSSION

Forest fragments

In addition to Mt. Palay-Palay, five secondary lowland forest fragments were identified (Figure 2). These areas have forest cover ranging from ca. 1 – 640 ha and were largely in lowland habitats with elevation ranging from 78-648 masl (Table 1, Figure 1). Two forest fragments, Evercrest and Kabangaan, are privately owned. Pintung Gubat was reported to be covered with 40 ha of forest but a mere ~1 ha remain (bordering riparian habitats) due to its conversion to agricultural lands. Buhay Forest, which was reported to be covered with 100 ha of forest, is only covered with ~ 5 ha of forest due to illegal logging, slash-and-burn or '*kaingin*' and most especially charcoal-making. The forested areas of Indang (~ 1 ha) are limited to riparian edges. Mt. Palay-

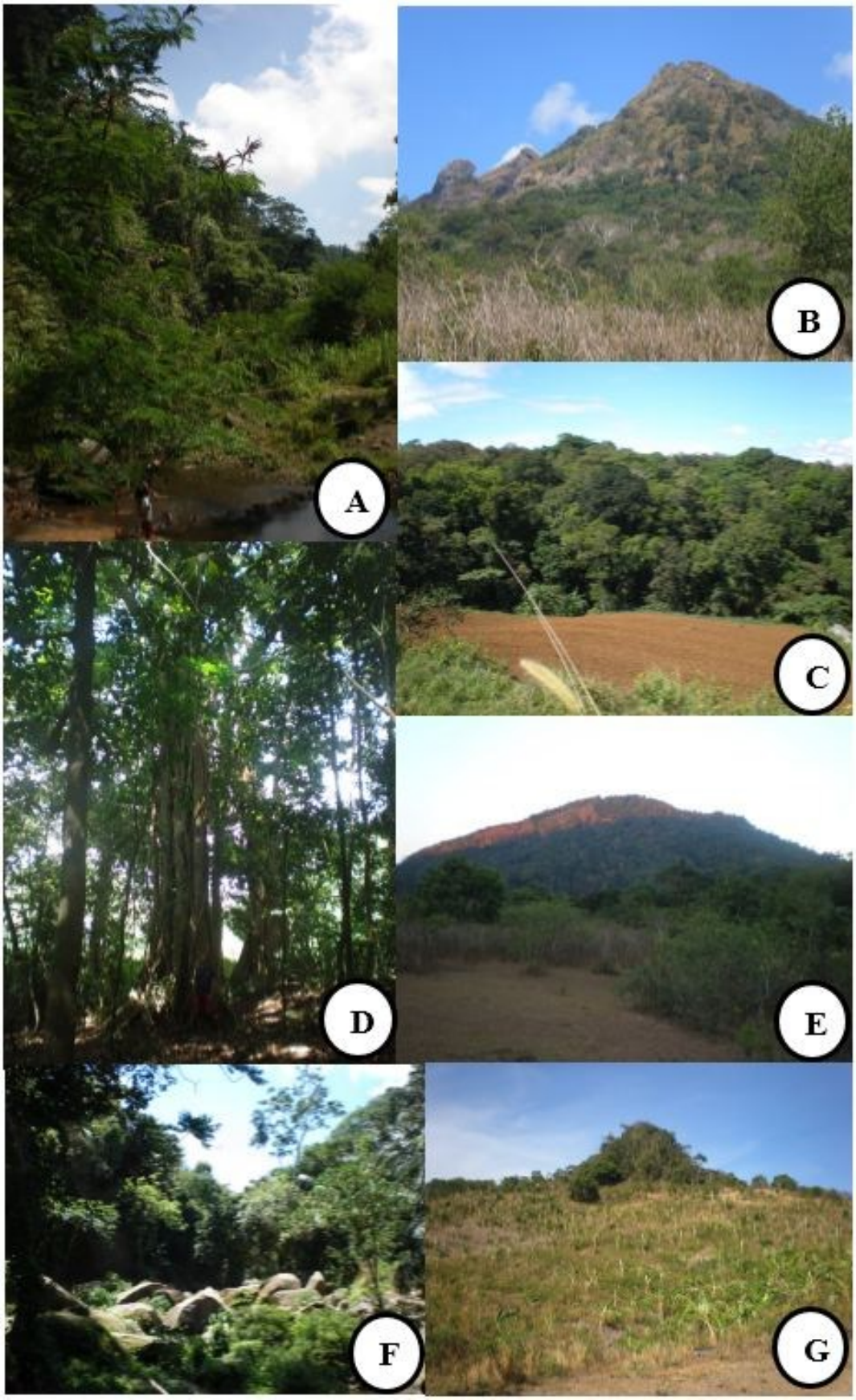

Table 1. Description of the study sites with biogeographic and ecological variables. Data for area are estimates.

Sites	Forest fragment	Locality	Coordinates	Elev. (masl)	Habitats available	Total no. of transects sampled	Total area sampled (in ha)	Forest Cover (in ha)	% sampled area relative to forest cover
1	Buhay	Brgy. San Agustin, Magallanes	14°11'39.1" N 120°42'51.1" E	284	mixed forest riparian forest natural forest	12	1.2	5	24%
2	Evercrest	Brgy. Amuyong, Alfonso	14°03'41.0" N 120°50'37.0" E	550	natural forest	8	0.8	4	20%
3	Indang	Brgy. Banaba Cerca, Indang	14°13'19.2" N 120°50'45.5" E	125	riparian forest	4	0.4	1	40%
4	Kabangaan	Brgy. Kabangaan, Silang	14°11'57.8" N 121°02'41.5" E	378	agroforest riparian forest natural forest	12	1.2	10	12%
5	Mt. Palay-Palay	Maragondon & Ternate	14°14'22.0" N 120°39'11.2" E	648	agroforest mixed forest riparian forest natural forest	32	3.2	640	0.50%
6	Pintung Gubat	Brgy. Urdaneta, Magallanes	14°10'19.0" N 120°43'09.8" E	78	riparian forest	4	0.4	1	40%
Total number of transects						**72**			

Palay is the only protected area in Cavite (Proc. No. 1315) and forest cover is only a mere 16% (Environmental Science for Social Change, 2010) from a previously reported 62.5% (DENR, 1992).

Species diversity

A total of 2,853 tree individuals belonging to 50 families, 127 genera, and 174 species was encountered in 72 transects from the forest fragments (Table 2). Table 4 lists these taxa by families, common names, ecological status, and IUCN's Red List category. Species diversity in all forest fragments was high as shown by their Shannon's diversity index (H′) values which were within the range of 1.5 to 3.5 (Magurran, 1988) and even higher as in the case of Buhay, Kabangaan, and Mt. Palay-Palay. Mt. Palay-Palay is the most diverse (containing the most rare species) among all fragments as indicated by its H′ value of 4.37. Based on its biological importance and degree of anthropogenic and economic pressure exerted on this area, the Philippine Biodiversity Conservation Priorities (PBCP) identified Mt. Palay-Palay as one of the 43 priority areas for plant conservation (or important plant areas) (DENR-PAWB, CI, and UP-CIDS, 2003). Mt. Palay-Palay was followed by Kabangaan with H′= 3.97 and Buhay with 3.75. Evercrest forest fragment had the lowest diversity as shown by its H′ value of 2.79 and the lowest evenness of 0.70 as this fragment was dominated by two species, *Bischofia javanica* and *Neotrewia cumingii.*

The importance value indices (IVIs) of tree species of the forest fragments fall within the range of IVIs of tropical forest inventories ranging from 12.5-52.4 (Pipoly and Madulid, 1997) and even higher in the case of Evercrest with *B. javanica* having an IVI of 70.99. The most important species for the fragments were *Swietenia macrophylla* (Buhay), *B. javanica* (Evercrest), *Macaranga hispida* (Indang), *Ficus nota* (Kabangaan), *Planchonia spectabilis* (Mt. Palay-Palay), and *Barringtonia racemosa* (Pintung Gubat). These species were also the most dominant species in their respective sites except *F. nota* (8th most dominant) in Kabangaan and *B. racemosa* (2nd most dominant) in Pintung Gubat. By having

Table 2. Summary of the species richness, IVIs, diversity indices, and ecological status.

Fragment	Number of				Most important species	IVI	H'	Ecological status		
	trees	families	genera	species				E	N	I
Buhay	470	29	60	75	*S. macrophylla*	22.01	3.75	16 (21.3%)	51 (68.0%)	8 (10.7%)
Evercrest	320	29	48	55	*B. javanica*	70.99	2.79	20 (36.4%)	34 (61.8%)	1 (1.8%)
Indang	157	22	33	41	*M. hispida*	29.70	3.29	11 (26.8%)	26 (63.4%)	4 (9.8%)
Kabangaan	480	35	62	86	*F. nota*	18.84	3.97	23 (26.7%)	60 (69.8%)	3 (3.5%)
Palay-Palay	1278	44	102	132	*P. spectabilis*	18.20	4.37	39 (29.5%)	80 (60.6%)	13 (9.8%)
Pintung Gubat	148	19	31	37	*B. racemosa*	48.18	3.08	10 (27.0%)	23 (62.2%)	4 (10.8%)
Total	2853	50	127	174				44 (25.3%)	114 (65.5%)	16 (9.2%)

Shannon's diversity index (H'); Ecological status, E = endemic, N = native, I = introduced/exotic

the largest basal area, dominant species contributed to bigger canopy closure that hindered the growth of shade tolerant species located in the understorey. The dominant species may be the densest, possess the highest biomass, occupy the most space, dictate energy flow and nutrient cycling, or by some other means control the structure and function of forest ecosystems by exerting a strong influence over the occurrence and distribution of other species (Smee, 2010; Hu *et al.*, 2008; Smith and Smith, 2002).

The most important species may also be the keystone species in each site. The importance of keystone species lies in its/their highly specialized relationship to other species (Primack, 2006). In this study, those identified as most important species (such as *Anthocephalus chinensis*, *Antidesma* spp., *Bauhinia malabarica*, *Bischofia javanica*, *Broussonetia luzonica*, *Canarium* spp., *Cinnamomum mercadoi*, *Dillenia philippinensis*, *Diospyros blancoi*, *Endospermum peltatum*, *Ficus* spp., *Gmelina arborea, Macaranga* spp., *Mangifera indica*, *Melanolepis multiglandulosa*, *Parkia roxburgii*, *Pisonia umbellifera*, *P. spectabilis, Pometia pinnata*, *Prunus grisea*, *Pterocymbium tinctorium, Samanea saman*, *Sandoricum koetjape*, *Syzygium calubcob*, *Terminalia nitens*, and *Vitex parviflora*) were sources of food (mainly fruits and seeds) to primates, birds, and other frugivorous vertebrates throughout the year. Frugivorous organisms serve as vital agents in the recruitment of wild food plants in forest patches and open areas (Tucker and Murphy, 1998).

Endemicity

Assessment of ecological status revealed that of the 174 species 114 (65.5%) are native/indigenous, 44 (25.3%) are endemic, and 16 (9.2%) are exotic/introduced species. Percentage of endemic species in Cavite ranged from 21% to 36% for the fragments and 25% for the whole province. This is low compared to the Philippines' flowering plant endemism ranging from 45% to 65% (Catibog-Sinha and Heaney, 2006; Mittermeier *et al.*, 1999; DENR-UNEP, 1997). Percentage of native species ranged from 61.0 % to 72% for the fragments and 66% for the province while exotic species from 1.8% - 9.8% for the fragments and 9.2% for the province. Exotic species such as *Anacardium occidentale*, *Artocarpus heterophyllus*, *Ceiba pentandra*, *Coffea arabica*, *Gliricidia sepium*, *Leucaena leucocephala*, *Mangifera indica, Psidium guajava*, and *Spathodea campanulata* have long been introduced into the country and have become naturalized throughout the country. However, 5 exotic species (*Acacia mangium*, *A. auriculiformis, G. arborea, S. saman*, and *S. macrophylla*) were deliberately introduced to mixed forests of Mt. Palay-Palay and Buhay as fast-growing species traditionally used by the government in its reforestation projects and industrial tree plantation in the country (Catibog-Sinha and Heaney, 2006; AKECOP, 2005; Lasco and Pulhin, 2003).

Conservation Status

The Philippines has 8000+ angiosperm species of which 440 are threatened (Amoroso and Aspiras, 2011). Cavite has 39 angiosperm species included in the IUCN 2011 Red List of Threatened Species and in The National List of Threatened Philippine Plants and their Categories (DENR, 2007) and of these, 19 (48.7%) are endemic (Tables 2 and 4). Cavite's threatened tree species represent 22.4% of the total number of species in Cavite and 8.9% of all threatened angiosperms in the Philippines. For trees listed as vulnerable (VU), endangered (EN), and critically endangered (CR), percentage of Red List or threatened species ranged from 12.2% -18.2% for the sites and 16.7% for Cavite with 16 endemic species included in the list (Table 3).

The five critically endangered tree species are *Shorea guiso*, *Diospyros blancoi*, *Pterocarpus indicus*, *Toona calantas*, and *Clerodendrum quadriloculare*. Two fragments, Buhay and

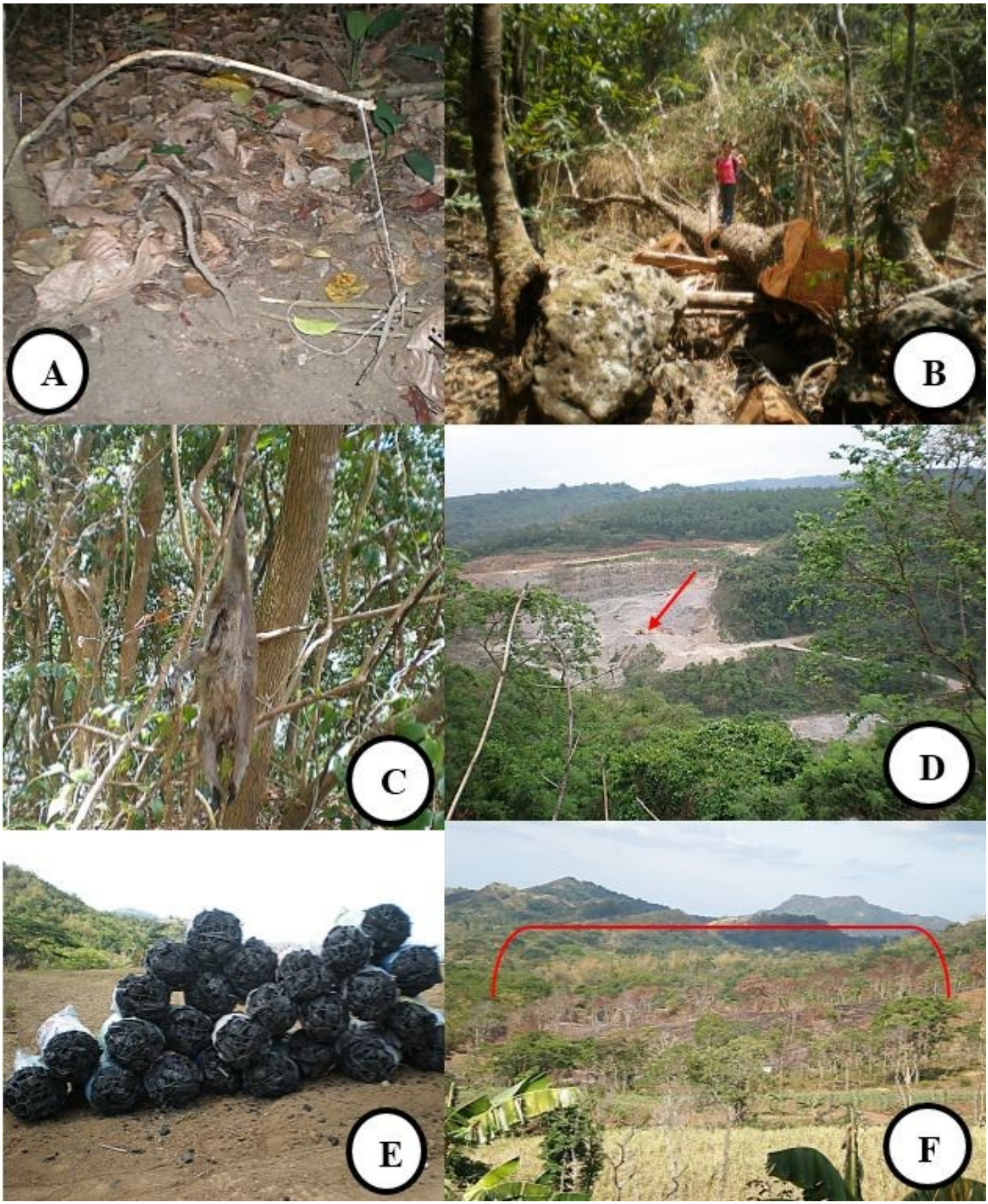

Table 3. An assessment of threatened species observed in the fragments.

Fragment	Number of species	IUCN Red List Category					Total	%
		CR	EN	VU	OTS	OWS/LR		
Buhay	75	3	4	5	4	3	19	25.33
Evercrest	55	3	-	6	3	2	14	25.45
Indang	41	1	1	3	2	-	7	17.07
Kabangaagn	86	1	1	11	3	5	21	24.42
Palay-Palay	132	3	5	15	4	6	33	25.00
Pintung Gubat	37	1	1	3	2	-	7	18.92
Total	174	5	5	18	4	7	39	22.41

CR = critically endangered, EN = endangered, VU = vulnerable, OTS = other threatened species,
OWS = other wildlife species/least concern
(Philippines = 440 threatened angiosperms; from Amoroso and Aspiras, 2011)
(See Table 4 for assessment per species)

Mt. Palay-Palay, are very important in the conservation of 5 endangered tree species: *Diospyros pilosanthera*, *D. pyrrocarpa*, *Afzelia rhomboidea*, *Lithi chinensis*, and *Vitex parviflora*. Mt. Palay-Palay and Kabangaan, however, are very important in the conservation of a majority of the vulnerable species. Overall, Mt. Palay-Palay houses the most number of threatened species. It is also home to 39 endemic tree species and notably the Cavite endemic species, *Impatiens caviteana*.

In addition, two species are also being threatened by trade as listed under the Convention on International Trade of Endangered Species of Wild Flora and Fauna (CITES). These are *S. macrophylla* (used as logs, sawn wood, veneer sheets and plywood) and *Cyathea* sp. (trunks are used in orchid-culture industry; Heaney and Regalado, 1998).

The gravest threat to Kabangaan is conversion of the remaining forest areas into agricultural plantations though riparian areas may be spared due to their steep slopes and difficult terrain. Evercrest is subjected to the least threat since the owner of this fragment strictly prohibited cutting of trees and harvesting of forest products and further encouraged family members to continue conserving this site. In a conversation with the head of security of the Evercrest Golf Club Resort, it was learned that security guards regularly patrolled the periphery and interior of the forest. However, small traps (Figure 3A) were also observed inside the forest which represent a threat to its fauna. Among the managed areas, Mt. Palay-Palay is subjected to more serious threats such as illegal logging, firewood gathering, poaching, quarrying, slash-and-burn or '*kaingin*', harvesting of non-timber forest products and even used as pasture areas. In most of the visits chain saws were heard throughout the day starting as early as 5:00 to 6:00 in the morning. When Mt. Mataas-na-Gulod (one of the peaks) was visited, several logging sites were also encountered (Figure 3B) proving that illegal logging still happens in the interior of the protected area. Poaching, especially of wild boars, monkeys, birds, monitor lizards (including the possible new species, *Varanus olivaceus*) was also observed. Some traps were left unchecked causing unnecessary death to animals (Figure 3C). The gravest threat so far is quarrying inside the protected area removing vast tracts of forests including its fauna (Figure 3D). Among the fragments accessible to the public, Buhay is subjected to threats such as logging, harvesting of forest products such as firewood, conversion to agricultural lands, and hunting of animals among others. The gravest threats being charcoal-making and kaingin (Figures 3E and F).

Overall, tree species diversity in Cavite's remaining forest fragments is high but all of these fragments are also subjected to different forms of anthropogenic pressures which can affect not only tree species but other fauna and flora as well. It is therefore highly recommended that these areas be protected and conserved including the diverse fauna and flora associated with these areas.

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Table 4. Taxonomic listing of trees alphabetically arranged by family. Local names in Tagalog and a few in English (E); Occurrence (+) of tree species per fragment (E=Evercrest, I=Indang, PG=Pintung Gubat) and habitat (R=riparian, M=mixed forest, A=agroforest, F=natural forest); ecological status, ES (E=endemic, N=native/ indigenous, I=introduced/exotic); red list category, RL (VU=vulnerable, EN=endangered, CR=critically endangered, OTS LR/nt=Other Threatened Species Lower Risk/ near threatened, OWS LR/lc=Other Wildlife Species Lower Risk/least concern, LR/lc=Lower Risk least concern). Red List Category based from IUCN Red List 2011 and The National List of Threatened Philippine Plants and their Categories 2007 (*). The plants were classified into families using the Angiosperm Phylogeny Group.

Family	Taxa	Local names	Occurence														
			Palay-Palay				Kabangaan			Buhay			E	I	PG	ES	RL
			R	M	A	F	R	A	F	R	M	F	F	R	R		
Actinidiaceae																	
	Saurauia latibractea Choisy	barosang, kolalabang							+							E	
Alangiaceae																	
	Alangium chinense (Lour.) Harms & Rehd.	kulis					+	+	+				+			N	
	Alangium longiflorum Merr.	malatapay					+	+								N	VU
Anacardiaceae																	
	Anacardium occidentale L.	kasuy			+										+	I	
	Buchanania arborescens (Blume) Blume	balinghasai	+	+	+	+							+			N	
	Dracontomelon dao (Blanco) Merr. & Rolfe	dao					+	+	+							N	*VU
	Dracontomelon edule (Blanco) Skeels	lamio				+			+			+				N	*VU
	Koordersiodendron pinnatum (Blanco) Merr.	amugis				+										N	*VU
	Mangifera indica L.	mangga		+	+					+	+			+	+	I	
	Semecarpus cuneiformis Blanco	alpay-gubat, hanagas, ligas	+	+	+	+	+				+		+	+	+	N	
Annonaceae																	
	Cananga odorata (Lam.) Hook. f. & Thoms.	ilang-ilang		+		+		+	+					+		N	
	Polyalthia flava Merr.	malakape, yellow lanutan (E)	+	+									+			E	

Table 4 continued.

Apocynaceae																	
	Alstonia macrophylla Wall. ex DC.	batino	+	+	+	+		+								N	LR/lc
	Alstonia scholaris (L.) R. Br.	dita	+		+	+			+		+	+	+		+	N	
	Voacanga globosa (Blanco) Merr.	bayag-usa		+	+			+	+							E	
	Wrightia pubescens R. Br.	lanete	+	+	+	+					+	+	+	+		N	
Araliaceae																	
	Polyscias nodosa (Blume) Seem	malapapaya	+	+	+	+	+	+				+		+		N	
Bignoniaceae																	
	Radermarchera pinnata (Blanco) Seem.	banay-banay		+		+										E	
	Spathodea campanulata Beauv.	African tulip											+			I	
Bombacaceae																	
	Ceiba pentandra (L.) Gaertn.	buboy, kapok, cucumber tree (E)		+	+							+				I	
Boraginaceae																	
	Cordia dichotoma Forst. f.	anonang			+		+				+			+	+	N	
Burseraceae																	
	Canarium asperum Benth.	pagsahingin	+	+	+	+					+					N	LR/lc
	Canarium luzonicum (Blume) A. Gray	piling-liitan		+	+	+			+	+	+	+	+	+	+	E	*OTS LR/nt
	Canarium ovatum Engl.	pili	+	+	+	+	+	+	+		+	+	+	+	+	E	*OTS LR/nt
	Garuga floribunda Decne	abilo	+	+		+										N	
Clusiaceae/ Guttiferae																	
	Calophyllum blancoi Pl. & Tr.	bitanghol, palo-maria	+	+		+										E	
	Cratoxylum formosum (Jack) Dyer	paguringon, salinggogon				+		+								N	LR/lc
	Cratoxylum sumatranum (Jack) Dyer	guyung-guyung		+	+			+		+	+	+				N	
	Garcinia binucao (Blanco) Choisy	binukaw, sinag-araw	+	+	+	+	+									N	
Combretaceae																	
	Terminalia microcarpa Decne	kalumpit		+												E	
	Terminalia nitens Presl.	kalumpit lalaki, sakat, talisay-gubat	+			+	+	+	+			+			+	N	VU

Table 4 continued.

Cyatheaceae																	
	Cyathea contaminans (Wall. Ex Hook.) Copel.	pakong-buwaya, tree fern (E)	+													N	*VU
Datiscaceae																	
	Octomeles sumatrana Miq.	barawisan, biluwa, binuang, libas							+							N	LR/lc
Dilleniaceae																	
	Dillenia philippinensis Rolfe	katmon	+	+		+				+			+			E	*OWS LR/lc
Dipterocar-paceae																	
	Shorea contorta Vid.	lawaan na maputi, white lauan	+													E	*VU
	Shorea guiso (Blanco) Blume	guijo	+	+	+	+	+					+				E	CR
	Shorea negrosensis Foxw.	red lauan		+		+										E	*VU
Ebenaceae																	
	Diospyros blancoi A. DC.	kamagong, mabolo	+	+		+						+	+	+	+	E	*CR
	Diospyros pilosanthera Blanco	bulong-ita	+	+	+	+				+		+				N	*EN
	Diospyros pyrrhocarpa Miq.	anang, luksa, butig baboy		+		+						+				N	*EN
Elaeocar-paceae																	
	Elaeocarpus monocera Cav.	tabian, tabyan				+										E	
Euphorbia-ceae																	
	Acalypha amentacea Roxb.	bogus					+	+	+							N	
	Acalypha hispida Burm. f.	buntot-pusa, Philippine medusa(E)					+		+				+	+	+	N	
	Antidesma bunius (L.) Spreng.	bignay kalabaw				+				+	+	+		+	+	N	
	Antidesma ghaesembilla Gaertner	binayoyo		+	+						+	+			+	N	
	Antidesma pentandrum (Blanco) Merr.	bignay pugo	+	+	+		+	+	+	+		+		+	+	N	
	Bischofia javanica Blume	tuai	+			+							+		+	N	
	Breynea cernua (Poir.) Muell.-Arg.	fart bush (E)						+								N	
	Croton tiglium L.	tuba, tubang-kamaisa					+									I	
	Dimorphocalyx luzoniensis Merr.	kulis, kulispakatan		+	+	+						+				E	
	Endospermum peltatum Merr.	gubas											+			N	
	Glochidion album (Blanco) Boerl.	malabagang				+	+	+								N	

Table 4 continued.

	Homalanthus populneus (Geisel.) Pax	bayanti, malabinunga							+							N	
	Macaranga bicolor Muell.-Arg.	binunga, hamindang		+			+	+	+							E	VU
	Macaranga grandifolia (Blanco) Merr.	takip-asin	+		+	+	+	+	+					+		E	VU
	Macaranga hispida (Blume) Muell.-Arg.	hamindang, lagapak	+				+	+	+					+		N	
	Macaranga tanarius (L.) Muell.-Arg.	binunga	+	+		+	+	+	+		+	+	+	+	+	N	
	Melanolepis multiglandulosa (Reinw.) Reichb. f. & Zoll.	alim, alok		+	+	+	+	+	+	+	+	+	+	+	+	N	
	Neotrewia cumingii (Muell.-Arg.) Pax & K. Hoffm.	apanang, malaikmo	+		+	+	+		+	+	+	+	+			E	
Fabaceae/ Leguminosae																	
	Abarema clyperia (Jack) Kosterm	malasampalok, malaipil-ipil	+	+	+	+			+							N	
	Acacia auriculoformis A. Cunn. Ex. Benth.	mangium (E)		+												I	
	Acacia mangium Willd.	mangium (E)		+							+					I	
	Afzelia rhomboidea (Blanco) Vidar	tindalo, balayong		+								+				E	*EN
	Albizia acle (Blanco) Merr.	akle	+		+						+	+			+	E	
	Albizia procera (Roxb.) Benth.	akleng-parang		+	+						+					N	
	Bauhinia malabarica Roxb.	alibangbang native		+	+						+	+				N	
	Bauhinia purpurea L.	alibangbang, Hongkong tree (E)		+	+											N	
	Cassia javanica L.	kinapistula, antsoan, pink shower (E)			+							+				I	
	Erythrina variegata L.	dapdap								+			+	+		N	
	Gliricidia sepium (Jacq.) Kunth ex. Walp.	kakawate			+		+			+				+		I	
	Leucaena leucocephala (Lam.) de Wit	ipil-ipil, elena			+									+	+	I	
	Parkia roxburgii G. Don	kupang	+	+	+	+						+		+		N	
	Pongamia pinnata (L.) Merr.	balok-balok, bani		+		+				+		+			+	N	
	Pterocarpus indicus Willd.	narra	+	+	+						+					N	*CR

Table 4 continued.

	Samanea saman (Jacq.) Merr.	acacia (E),akasya, rain tree (E)	+	+	+					+	+			+	+	I	
Fagaceae																	
	Lithocarpus sulitii Soepadmo	pangnan, Phil. oak (E), ulayan		+		+							+			E	
Flacourtiaceae																	
	Trichadenia philippinensis Merr.	tondong, tandong	+	+												N	
Icacinacaeae																	
	Gomphandra luzoniensis (Merr.) Merr.	mabunot		+					+				+			E	
	Gonocaryum calleryanum (Baill.)	anilao, malatapai, tamayuang-puti, tengang-baboy		+		+	+	+	+			+				N	
Lamiaceae	Lamiaceae																
	Clerodendrum quadriloculare (Blanco) Merr.	bagawak morado											+			N	*CR
	Gmelina arborea Roxb.	gmelina (E), melina, paper tree (E), yemane (E)		+	+					+	+					I	
	Premna odorata Blanco	alagaw													+	N	
	Vitex parviflora Juss.	molave, mulawin	+	+	+		+	+	+			+		+	+	N	*EN
Lauraceae	Lauraceae																
	Cinnamomum mercadoi Vid.	kalingag	+			+			+			+	+			E	VU
	Litsea perrottetii (Blume) Fern.-Vill.	batikuling, marang							+				+			N	
	Neolitsea villosa (Blume) Merr.	batikuling, bohian	+	+	+	+					+	+		+	+	N	
Lecythidaceae	Lecythidaceae																
	Barringtonia racemosa (L.) Blume ex DC.	putat	+	+	+	+				+		+		+	+	N	
	Planchonia spectabilis Merr.	lamog	+	+	+	+	+	+	+				+		+	E	
Leeaceae	Leeaceae																
	Leea guineensis G. Don	abang-abang, mali-mali, sipit-kaing	+		+											N	
	Leea philippinensis Merr.	kaliantan		+	+	+		+	+	+		+		+		E	
Lythraceae	Lythraceae																
	Lagerstroemia speciosa (L.) Pers.	banaba	+	+	+		+	+	+	+	+	+	+	+	+	N	
Melastomataceae	Melastomataceae																
	Memecylon lanceolatum Blanco	kulis	+													N	

Table 4 continued.

Meliaceae																	
	Aglaia rimosa (Blanco) Merr.	balanti, bayanti, balubar	+			+						+			N	*VU
	Aphanamixis polystachya (Wall.) R.N. Parker	kangko						+							N	*VU
	Chisocheton cumingianus (C. DC.) Harms	salab, balukanag, batuakan				+					+				N	
	Chisocheton pentandrus (Blanco) Merr.	katong-matsing	+			+	+		+						N	
	Dysoxylum cumingianum C. DC.	tara-tara		+	+	+	+	+			+			+	N	
	Dysoxylum gaudichaudianum (A. Juss.) Miq.	igyo, malasapsap					+		+		+				N	
	Dysoxylum oppositifolium F.v. Muell.	kayataw, pink mahogany (E)		+									+		N	
	Dysoxylym parasiticum (Osb.) Kosterm.	daray					+								N	
	Sandoricum koetjape (Burm. f.) Merr.	santol	+	+	+	+	+	+	+	+	+		+	+	N	
	Swietenia macrophylla King	big-leaved mahogany (E)			+					+	+				I	VU
	Toona calantas Merr. & Rolfe	kalantas											+		E	*CR
Moraceae																	
	Artocarpus altilis (Park.) Fosb.	rimas						+	+						N	
	Artocarpus blancoi (Elm.) Merr.	antipolo		+	+	+		+	+	+	+		+	+	+	E	VU
	Artocarpus heterophyllus Lamk.	langka			+											I	
	Artocarpus ovatus Blanco	anubing				+	+	+								E	
	Broussonetia luzonica (Blanco) Burr.	himbabao						+	+		+	+				N	
	Ficus ampelas Burm. f.	mala-isis, upling-gubat							+							N	
	Ficus balete Merr.	balete					+	+					+	+		E	
	Ficus benjamina L.	baleteng-ibon, salisi													+	N	
	Ficus botryocarpa Miq.	tibig, basikong, daing-daing					+									N	
	Ficus callosa Willd.	bagarila, kalukoy					+									N	
	Ficus gul Laut. & K. Schum.	butli	+				+	+	+	+			+			N	
	Ficus magnoliifolia Blume	hanapay, kanapai											+			N	
	Ficus minahassae (Teijsm.& de Vr.) Miq.	hagimit					+	+					+	+		N	

Table 4 continued.

	Ficus nota (Blanco) Merr.	tibig	+	+	+	+	+	+	+	+			+	+	+	N	
	Ficus odorata (Blanco) Merr.	as-is, is-is, pakiling					+		+					+	+	E	
	Ficus pseudopalma Blanco	lamiog, lubi-lubi, niyog-niyogan, repolyong-gubat	+										+			E	
	Ficus septica Burm. f.	hauili, hawili	+	+	+	+	+	+	+	+				+	+	N	
	Ficus sp. (trivein) L.		+	+		+		+				+	+				
	Ficus variegata Blume	tangisang-bayawak	+	+	+	+		+		+						N	
	Streblus asper Lour.	as-is maya, tsaang-gubat, kalios	+			+		+	+	+	+	+	+	+		N	
Myristicaceae																	
	Knema glomerata (Blanco) Merr.	tambalaw	+			+			+	+			+			N	LR/lc
	Myristica philippensis Lamk.	duguan	+			+	+	+	+			+	+			E	*OTS LR/nt
Myrsinaceae																	
	Ardisia pyramidalis (Cav.) Pers.	aunasin	+	+												N	
	Ardisia squamulosa Presl.	tagpo				+							+		+	E	VU
Myrtaceae																	
	Decaspermum fruticosum J.R. & G. Forst.	masalisi, Tagaytay cherry (E)		+		+										N	
	Psidium guajava L.	bayabas			+											I	VU
	Syzygium calubcob (C.B. Rob.) Merr.	kalubkob	+	+		+	+			+				+	+	E	
	Syzygium cumini (L.) Skeels	duhat		+	+						+					N	
	Syzygium gratum (Wight) S.N. Mitra	malaruhat	+	+		+						+	+			N	
Nyctaginaceae																	
	Pisonia umbellifera (Forst.) von Seem.	anuling, buringgot											+			N	
Olacaceae																	
	Anacolosa frutescens (Blume) Blume	galo		+	+	+				+						N	
	Strombosia philippinensis (Baill.) Rolfe	tamayuan	+	+		+	+	+	+					+		E	
Opiliaceae																	
	Champereia manillana (Blume) Merr.	garimo			+											N	

Table 4 continued.

Phyllanthaceae																
	Bridelia insulana Hance	subyang	+	+	+	+						+			N	
Rhamnaceae																
	Ziziphus talanai (Blanco) Merr.	duklap		+	+						+				E	*OTS LR/nt
Rhizophoraceae																
	Carallia brachiata (Lour.) Merr.	bakawan gubat, anosep, katolit	+					+			+				N	
Rosaceae																
	Prunus grisea (C. Muell.) Kalkm.	lago	+					+							N	LR/lc
Rubiaceae																
	Anthocephalus chinensis (Lam.) Rich. Ex. Walp.	bangkal	+	+	+	+			+	+		+	+		N	
	Canthium horridum Blume	malatadyang, suyak-daga	+	+											N	
	Coffea arabica (L.)	kape						+							I	
	Ixora longistipula Merr.	matang-hipon, mayanman			+										E	
	Mitragyna diversifolia (Wall. ex G. Don) Havil.	mambog				+					+				N	
	Morinda citrifolia L.	nino									+				N	
	Neonauclea bartlingii (DC.) Merr.	lisak	+		+										E	
Rutaceae																
	Citrus maxima (Burm. f.) Merr.	lukban, suha											+		N	
	Melicope triphylla (Lam.) Merr.	matang-araw					+	+							E	
Sapindaceae																
	Allophylus cobbe (L.) Raeusch.	tit berry (E)					+								N	
	Guioa koelreuteria (Blanco) Merr.	alahan, salab, solob		+											E	
	Harpullia arborea (Blanco) Radlk.	puwas	+												N	
	Litchi chinensis Sonn.	alupag, alpay		+		+									E	*EN
	Mischocarpus pentapetalus (Roxb.) Radlk.	ambalag, malagiting-giting	+	+		+						+			N	
	Nephelium ramboutan-ake (Labill.) Leenh.	bulala, kapulasan, rambutan										+			N	
	Pometia pinnata J.R. & G. Forst.	malugai		+											N	
	Pometia sp. J.R. & G. Forst.											+				

Table 4 continued.

Sapotaceae	Sapotaceae																
	Palaquium foxworthyi Merr.	tagotoi											+			E	
Sterculiaceae	Sterculiaceae																
	Heritiera sylvatica Vid.	dungon	+													N	
	Pterocymbium tinctorium (Blanco) Merr.	taluto		+	+	+			+			+	+			N	
	Pterospermum diversifolium Blume	bayog babae	+	+	+	+	+				+	+		+		N	
	Pterospermum obliquum Blanco	dungon, bayog lalaki, kulatingan	+	+			+					+	+		+	E	
	Sterculia cordata Blume	tapinag-bundok				+		+								N	
	Sterculia foetida L.	banilad, kalumpang										+				N	
Theaceae	Theaceae																
	Camelia lanceolata (Blume) Seem.	haikan	+													N	
Tiliaceae	Tiliaceae																
	Diplodiscus paniculatus Turcz.	balobo				+			+				+			E	VU
	Grewia multiflora Juss.	lapnis			+	+					+		+			N	
	Microcos stylocarpa (Warb.) Burr.	aporong, kamuling, pulit				+	+						+			N	
Ulmaceae	Ulmaceae																
	Celtis luzonica Warb.	magabuyo, daloo				+	+	+	+				+	+		E	VU
	Celtis philippensis Blanco	malaikmo	+				+									N	
Urticaceae	Urticaceae																
	Dendrocnide meyeniana (Walp.) Chew	lipa, lipang-kalabaw			+		+						+		+	N	
	Leucosyke capitellata (Poir.) Wedd.	alagasi	+	+	+		+		+	+		+				N	
	Pipturus arborescens (Link) C.B. Rob.	mala-lipa					+									N	
	Villebrunea trinervis Wedd.								+				+			N	
Subtotal	Subtotal		69	80	65	75	51	45	55	30	32	50	55	41	37		
Total			132				86			75			55	41	37		

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